June 2000

Mathematics 30

Grade 12 Diploma Examination

Alberta
LEARNING

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Mathematics 30

Grade 12 Diploma Examination

Description

Time: This examination was developed to be completed in 2.5 h; however, you may take an additional 0.5 h to complete the examination.

This is a **closed-book** examination consisting of

- 40 multiple-choice and 9 numerical-response questions, of equal value, worth 70% of the examination
- 3 written-response questions, of equal value, worth 30% of the examination

A tear-out formula sheet and a z-score page are included in this booklet.

All graphs on this examination are computer-generated.

Note: *The perforated pages at the back of this booklet may be torn out and used for your rough work.*
No marks *will be given for work done on the tear-out pages.*

Instructions

- You are expected to provide your own scientific calculator.
- Use only an HB pencil for the machine-scored answer sheet.
- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- Read each question carefully.
- Consider all numbers used in the questions to be **exact** numbers and not the result of a measurement.
- If you wish to change an answer, erase **all** traces of your first answer.
- Do not fold the answer sheet.
- The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Learning.
- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.

Multiple Choice

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

Example

This examination is for the subject of

A. biology
B. physics
C. chemistry
D. mathematics

Answer Sheet

Ⓐ Ⓑ Ⓒ ●

Numerical Response

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.7), then be sure to record the 0 before the decimal place.
- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

Examples

Calculation Question and Solution

Correct to the nearest tenth of a radian, 40° is equal to _____ rad.

$40^\circ = 0.6981317008 \ldots \text{ rad}$
$= 0.7$

(Record your answer in the numerical-response section on the answer sheet.)

Record 0.7 on the answer sheet →

Correct-Order Question and Solution

When the following subjects are arranged in alphabetical order, the order is _____, _____, _____, and _____.

1 biology
2 physics
3 chemistry
4 mathematics

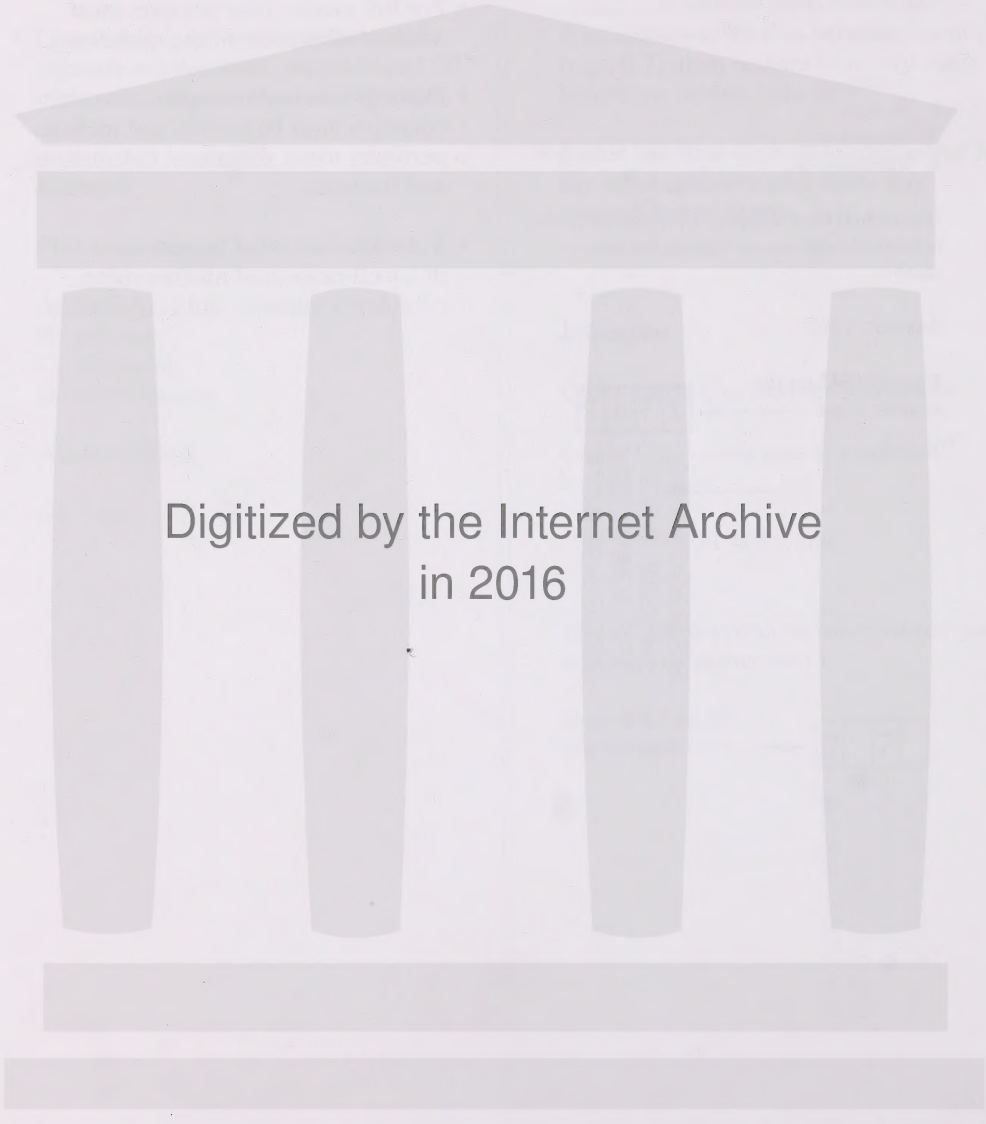
(Record **all four digits** of your answer in the numerical-response section on the answer sheet.)

Answer: 1342

Record 1342 on the answer sheet →

Written Response

- Write your answers in the examination booklet as neatly as possible.
- For full marks, your answers must address **all** aspects of the question.
- Descriptions and/or explanations of concepts must be correct and include pertinent ideas, diagrams, calculations, and formulas.
- Your answers must be presented in a well-organized manner using complete sentences and correct units.



1. If the polynomial $P(x) = 2x^4 + x^3 - 4x^2 + 1$ is divided by $x + \frac{1}{2}$, then the remainder is

A. $-\frac{1}{2}$

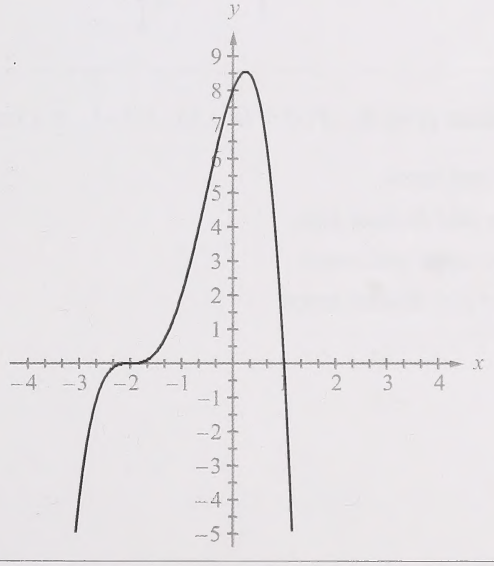
B. 0

C. $\frac{1}{4}$

D. 3

Use the following information to answer the next question.

The partial graph of a fourth-degree polynomial function $y = P(x)$ is shown below. The graph has x-intercepts of -2 and 1, and a y-intercept of 8.



2. The equation of the polynomial function, P, is

A. $P(x) = (x - 1)(x + 2)^3$

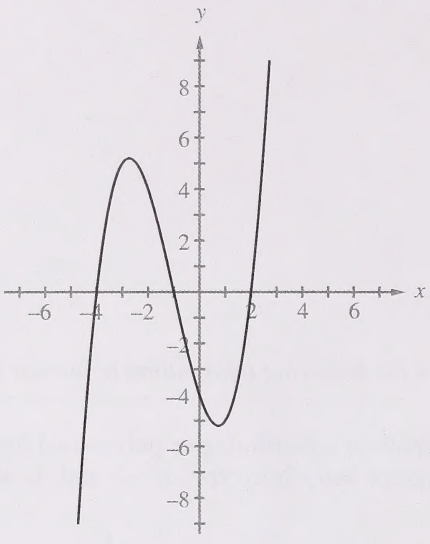
B. $P(x) = (x + 1)(x - 2)^3$

C. $P(x) = -(x - 1)(x + 2)^3$

D. $P(x) = -(x + 1)(x - 2)^3$

Use the following information to answer the next question.

A partial graph of a third-degree polynomial function $y = P(x)$ is shown below. The graph has x-intercepts at -4, -1, and 2.



3. The quotient given by $P(x) \div (x + 1)$, $x \neq -1$, is a function with

A. no real zeros

B. one real distinct zero

C. two equal real zeros

D. two real distinct zeros

4. For the graphs of the polynomial functions $y = P(x)$ and $y = Q(x)$, the x-coordinates of the points of intersection are found by solving

A. $P(x) - Q(x) = 0$

B. $P(x) + Q(x) = 0$

C. $P(x) \times Q(x) = 0$

D. $P(x) \div Q(x) = 0$

5. If $(x - 3)$ is a factor of the polynomial function P, where $P(x) = x^3 - 2x^2 + kx + 6$, then the value of k is

A. -13

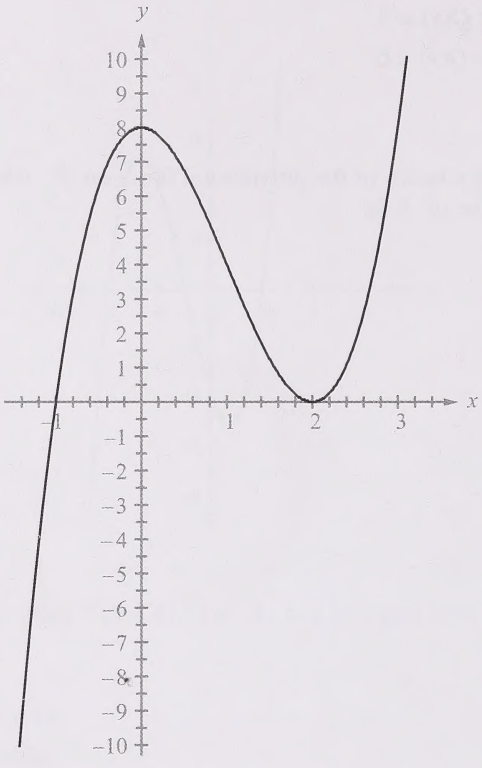
B. -5

C. 5

D. 13

Use the following information to answer the next question.

A student graphed a third-degree polynomial function and obtained the partial graph shown below. The x-intercepts are -1 and 2, and the y-intercept is 8.



Numerical Response

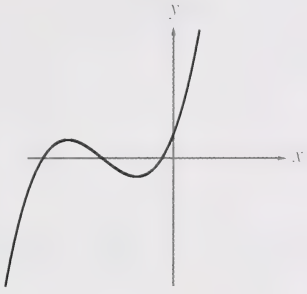
1. If the point $(15, b)$ is on the graph of the function, then the value of b is _____.

(Record your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

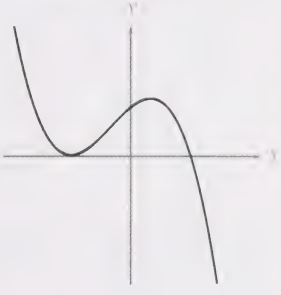
For each of three cubic polynomial functions, a partial graph is shown below.

Graph 1



Graph 2

Graph 3



Numerical Response

2. Match each of the graphs, as numbered above, with the number of distinct zeros corresponding to it, as given below.

1 distinct zero _____ (Record in the first column.)
2 distinct zeros _____ (Record in the second column.)
3 distinct zeros _____ (Record in the third column.)

(Record **all three digits** of your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

Three trigonometric functions are given below.

$$f(\theta) = 2\sin 3\left(\theta - \frac{\pi}{2}\right)$$

$$g(\theta) = \sin 3\theta + 6$$

$$k(\theta) = 3\sin\theta + 6$$

6. After correctly graphing the three trigonometric functions, a student found that

A. none of the graphs have the same period

B. all of the graphs have the same period

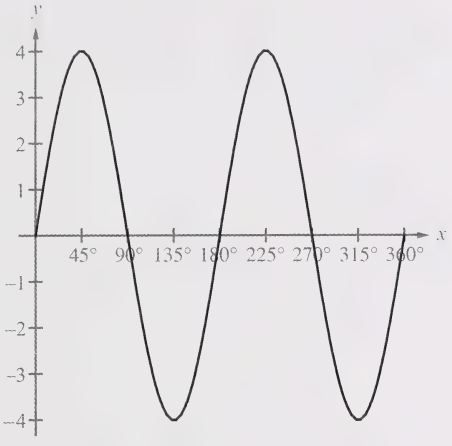
C. only the graphs of $y = g(\theta)$ and $y = k(\theta)$ have the same period

D. only the graphs of $y = f(\theta)$ and $y = g(\theta)$ have the same period

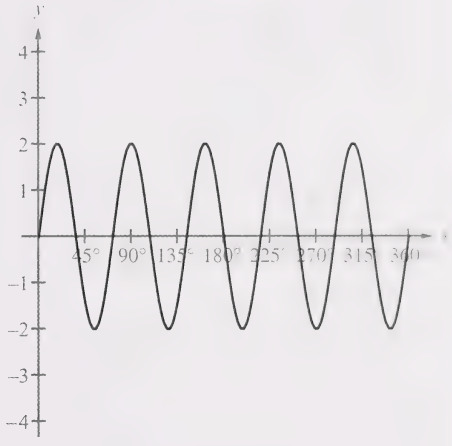
Use the following information to answer the next question.

Four sound waves are modelled by the following graphs of trigonometric functions. The portion of each graph on the domain $0° \leq x \leq 360°$ is shown below.

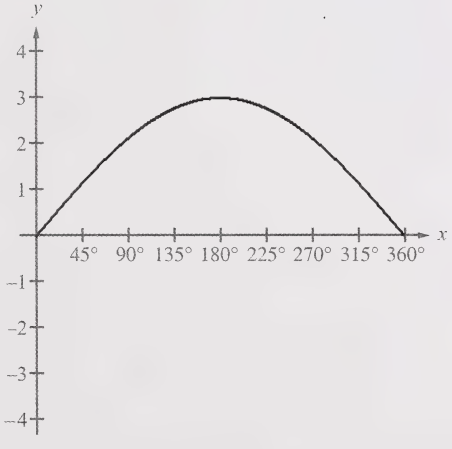
Graph 1



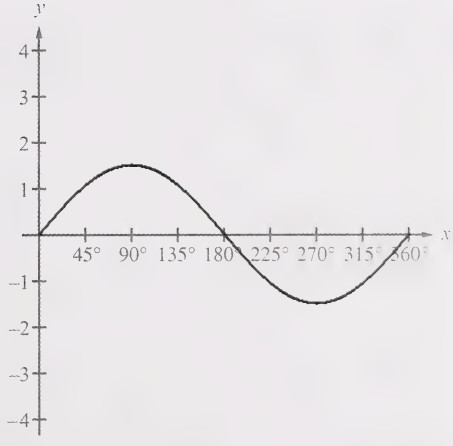
Graph 2



Graph 3



Graph 4



7. The louder a sound is, the greater the amplitude of its sound wave. Therefore, the graph above that corresponds to the loudest sound is

A. graph 1

B. graph 2

C. graph 3

D. graph 4

8. A student was asked to determine an expression for $\cos(2x)$, given $\cos x = k$. He began with $\cos(2x) = \cos(x + x)$ and determined that an expression for $\cos(2x)$, in terms of k, is

A. -1

B. $2k$

C. $2k - 1$

D. $2k^2 - 1$

9. The graphs of $y = a\cos\theta$ and $y = 2$ intersect at $\theta = \frac{\pi}{3}$ and $\theta = \frac{5\pi}{3}$, where $0 \leq \theta \leq 2\pi$. The value of a in $y = a\cos\theta$ is

A. 0.25

B. 1

C. 2.3

D. 4

10. The expression $\frac{1 + \sec\theta}{\cos\theta}$ is equivalent to

A. 2

B. $\frac{2}{\cos\theta}$

C. $\frac{\cos\theta + 1}{\cos^2\theta}$

D. $\frac{\cos\theta + 1}{1 + \sin^2\theta}$

11. If $\sin\theta - \cos\theta = 0,\ 0 \le \theta \le 2\pi,$ then the values of θ are

A. $\frac{\pi}{4}$ and $\frac{5\pi}{4}$

B. $\frac{\pi}{4}$ and $\frac{3\pi}{4}$

C. $\frac{3\pi}{4}$ and $\frac{5\pi}{4}$

D. $\frac{5\pi}{4}$ and $\frac{7\pi}{4}$

12. If $\sin\theta = 0.8$ and $\frac{\pi}{2} < \theta < \pi$, then $\tan\theta$ is

A. $-\frac{4}{5}$

B. $-\frac{4}{3}$

C. $-\frac{3}{5}$

D. $-\frac{3}{4}$

13. The functions f, g, and h are defined for $x \in \Re$ as

$$f(x) = x^3$$
$$g(x) = \sin x$$
$$h(x) = 2^x$$

If each of these functions is multiplied by a constant k, where $k > 1$, then the range of the function will be changed for

A. g only

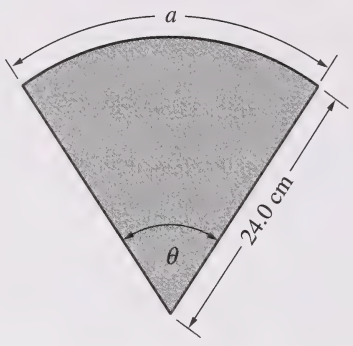
B. h only

C. f and g only

D. f and h only

Use the following information to answer the next question.

A student makes a conical filter from a circular piece of paper that has a radius of 24.0 cm. The student cuts out a sector with central angle θ and then tapes the cut edges of the remaining piece together.



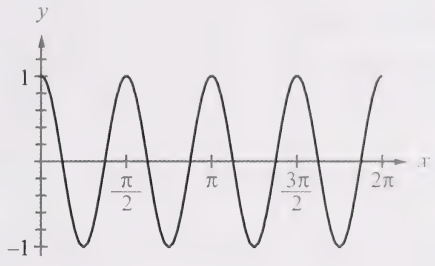
Numerical Response

3. If the student increases angle θ by 0.1 rad, then the arc length, a, of the new cutout sector, correct to the nearest tenth of a centimetre, increases by _____ cm.

(Record your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

A partial graph of $y = \cos bx,\ b \in N,$ is shown below.



Numerical Response

4. The value of b, correct to the nearest whole number, is _____.

(Record your answer in the numerical-response section on the answer sheet.)

14. The expression $\log(\sin x) - \log(\cos x),\ 0 < x < \frac{\pi}{2}$, is equal to

A. $\log(\tan x)$

B. $\log(\sin x - \cos x)$

C. $\log(\sin x \cos x)$

D. $\log(\sin x + \cos x)$

15. The graph of $y = \log_4 x$, where $x > 0$, lies entirely

A. above the x-axis
B. below the x-axis
C. to the left of the y-axis
D. to the right of the y-axis

16. In the equation $\log_{(x+2)} 5 = 10$, the value of x, correct to the nearest hundredth, is

A. -0.42
B. -0.83
C. -1.41
D. -1.50

17. If $\log_2(\sin\theta) = -1$, then $\log_2(\csc\theta)$ equals

A. -1

B. $\frac{1}{2}$

C. 1

D. 2

18. If $x^{\frac{2}{3}} = 28$, then $\log x$, correct to the nearest hundredth, is

A. 2.17
B. 9.22
C. 1.45
D. 0.96

19. The population of a city is increasing at a constant rate of 5% per year. The city's present population is 200 000. The minimum number of years it will take for the population to exceed 500 000 is

A. 18 years

B. 19 years

C. 20 years

D. 21 years

Use the following information to answer the next question.

The point $P\left(-1, \frac{1}{3}\right)$ lies on the graph of the exponential function $f(x) = b^x$.

20. The value of the base, b, of the exponential function, f, is

A. $\frac{1}{3}$

B. 3

C. $-\frac{1}{3}$

D. -3

Use the following information to answer the next question.

The market price of houses in a particular city is predicted to rise at a yearly rate of 3% per annum. Property tax, which is calculated once per year, is 1% of the market price of a house.

In order to predict the future market value and property tax for his house, Mike made the following chart.

	Current Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Market Price	120 000	123 600				
Property Tax	1 200	1 236				

Numerical Response

5. In year 5, the property tax on Mike's house, correct to the nearest dollar, will be $\$\_\_\_\_\_$.

(Record your answer in the numerical-response section on the answer sheet.)

21. The first term of a geometric sequence is 16, and the common ratio is $-\frac{1}{2}$. The sum of the first 7 terms of this geometric sequence is

A. 114

B. 31.75

C. 10.75

D. 0.25

22. In a theatre, chairs have been placed in rows for a performance. The front row has 26 chairs, and each of the following rows has 4 more chairs than the previous row. If 728 chairs were placed in this arrangement, then the number of rows of chairs would be

A. 13

B. 14

C. 15

D. 16

23. The value of $\sum_{k=5}^{15}\left(2^{k-1}\right)$ is

A. 16 368

B. 16 383

C. 32 752

D. 32 767

24. On a particular cruise ship, the cabin numbers on one side of the main deck form an arithmetic sequence. If the first two cabins are numbered 403 and 407 and the last cabin is numbered 627, then the number of cabins on this side of the deck is

A. 55 cabins

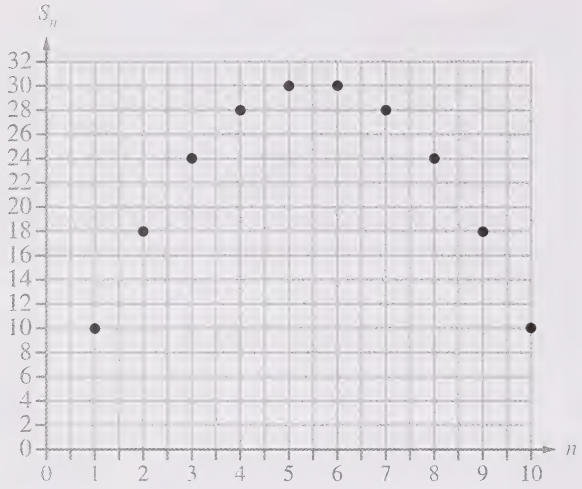
B. 56 cabins

C. 57 cabins

D. 58 cabins

Use the following information to answer the next question.

The first term of an arithmetic sequence is 10 and the common difference is an integer. The graphical representation of the sum of the terms of this arithmetic sequence is shown below.



25. The general term of this arithmetic sequence is

A. $t_n = 12 - 2n$

B. $t_n = 11 - n^2$

C. $t_n = 8 + 2n$

D. $t_n = 8 - 2n$

---

26. A 3 m length of wood is cut into 6 pieces. When the pieces are arranged from shortest to longest, their lengths form an arithmetic sequence. If the difference in the length of consecutive pieces is 0.10 m, then the length of the shortest piece is

A. 0.20 m

B. 0.25 m

C. 2.50 m

D. 2.70 m

Use the following information to answer the next question.

Four sequences, each with five terms, are given below.

Sequence 1 $1,\ -1,\ -3,\ -5,\ -7$

Sequence 2 $\frac{1}{2},\ -\frac{1}{4},\ \frac{1}{8},\ -\frac{1}{16},\ \frac{1}{32}$

Sequence 3 $1,\ 1.1,\ 1.2,\ 1.3,\ 1.4$

Sequence 4 $\frac{1}{2},\ 0,\ -\frac{1}{2},\ -1,\ -\frac{3}{2}$

Numerical Response

6. Match two of the sequences, as numbered above, to the statements below that describe them.

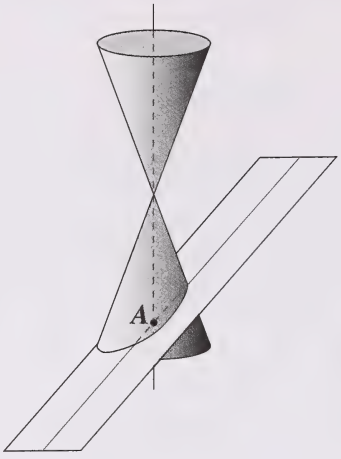
The geometric sequence with common ratio r, where $r < 0$,
is _____. (Record in the first column.)

The arithmetic sequence with common difference d, where $d > 0$,
is _____. (Record in the second column.)

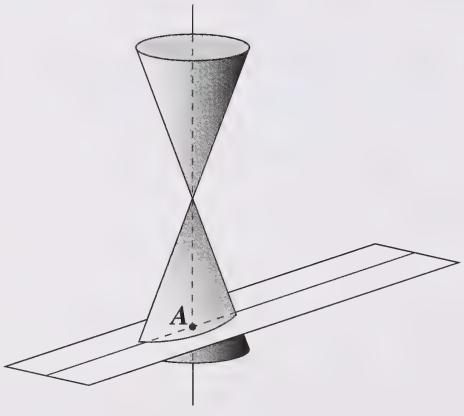
(Record the **two digits** of your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

A plane intersects the axis of symmetry of a double-napped cone at point A, as shown below.



The plane is then rotated about point A and a new conic section is formed, as shown below.



27. When comparing the new conic section to the old conic section, a student determined that

A. the foci are the same distance apart

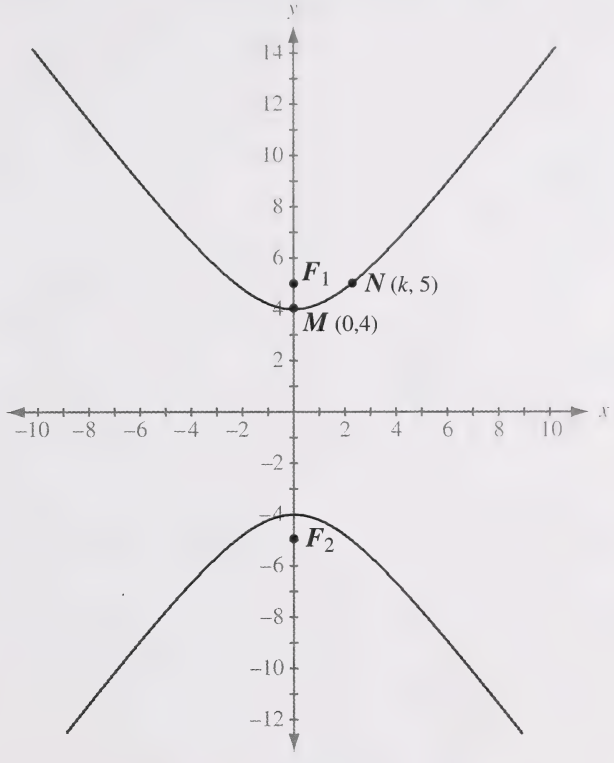
B. the foci are farther apart in the new conic section

C. the foci are closer together in the new conic section

D. there is insufficient information to conclude anything about the distance between the foci

Use the following information to answer the next question.

The hyperbola shown below has foci at $F_1(0, 5)$ and $F_2(0, -5)$. Two points on the hyperbola are $M(0, 4)$ and $N(k, 5)$.



A student was asked to determine the value of k, correct to the nearest hundredth. The student began the problem by determining the constant difference $|MF_1 - MF_2|$ to be $|1 - 9| = 8$. Next, the student set up the equation $|NF_1 - NF_2| = 8$.

28. The student determined the correct value of k to be

A. 1

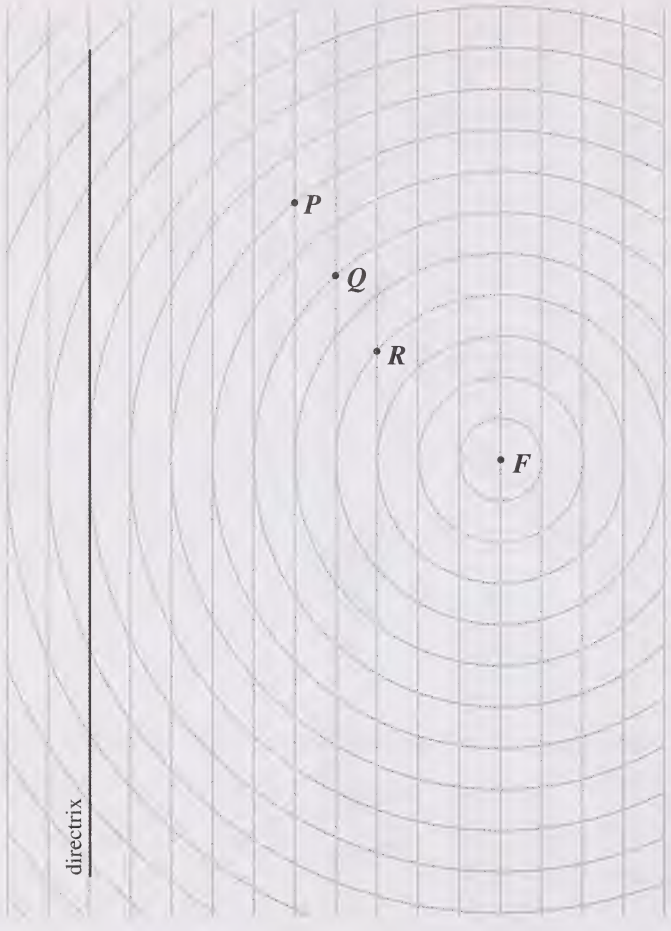
B. $\frac{5}{4}$

C. 2

D. $\frac{9}{4}$

Use the following information to answer the next question.

Three points labelled P, Q, and R are shown on the circle–line graph paper below. Each point is on a different quadratic relation. The quadratic relations all have a focus at F and a directrix as labelled.



29. The points P, Q, and R must be on the quadratic relations of, respectively,

A. an ellipse, a parabola, and a hyperbola

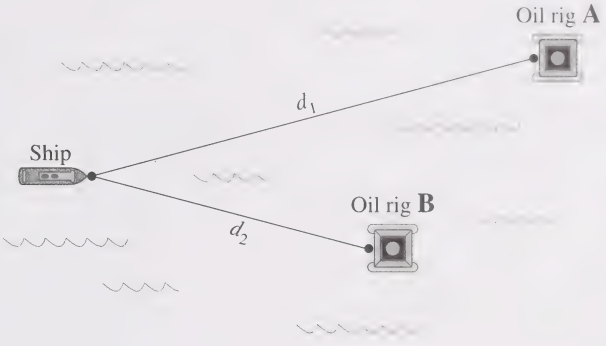
B. an ellipse, a hyperbola, and a parabola

C. a hyperbola, an ellipse, and a parabola

D. a hyperbola, a parabola, and an ellipse

Use the following information to answer the next question.

In the diagram below, two fixed offshore oil rigs are labelled A and B. A ship's path forms a conic with the oil rigs as foci. The distance from the ship to oil rig A is labelled d_1, and the distance from the ship to oil rig B is labelled d_2. Over a certain period of time, the difference in the two distances, d_1 and d_2, is a constant.



30. The type of conic formed by the ship's path is

A. a hyperbola

B. a parabola

C. an ellipse

D. a circle

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31. Point P moves such that the sum of its distances from two distinct fixed points remains constant. If the equation that corresponds to its locus is written in the form $Ax^2 + Cy^2 + F = 0,\ F < 0,$ then

A. $A = C$

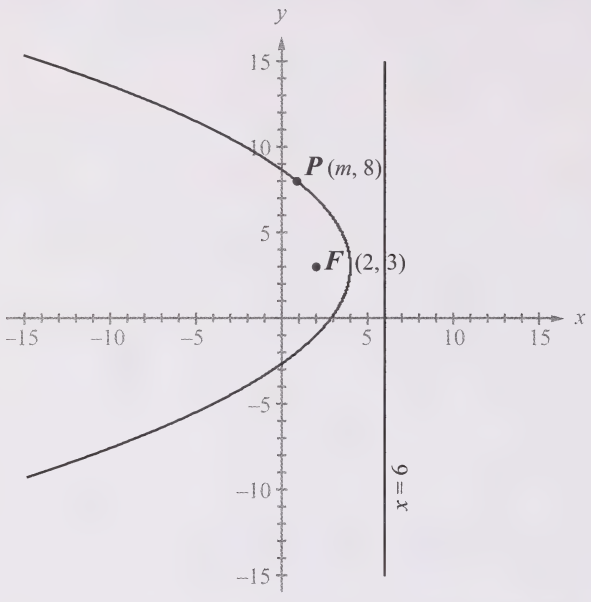
B. $A > 0,\ C > 0,\ A \neq C$

C. $A > 0,\ C < 0,\ A \neq C$

D. $A < 0,\ C < 0,\ A \neq C$

Use the following information to answer the next question.

The parabola shown below has focus $F(2, 3)$ and directrix $x = 6$.



32. If point $P(m, 8)$ is on the parabola, then the value of m, correct to the nearest tenth, is

A. 8.9

B. 5.3

C. 1.0

D. 0.9

Use the following information to answer the next question.

Three conditions describing the eccentricity of conic sections are shown below.

1 $e = 1$
2 $0 < e < 1$
3 $e > 1$

Numerical Response

7. Match each of the conditions, as numbered above, to the quadratic relation below that corresponds to it. The conditions can be used more than once.

$2x^2 + y - 3 = 0$ _____ (Record in the first column.)

$5x^2 - 4y^2 - 25 = 0$ _____ (Record in the second column.)

$3x^2 + 2y^2 - 10 = 0$ _____ (Record in the third column.)

(Record **all three digits** of your answer in the numerical-response section on the answer sheet.)

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33. A manufacturer claims that the number of candies in a bag is normally distributed with a mean of 60 candies. A person checking this claim finds that 68% of the bags contain between 57 and 63 candies. The approximate standard deviation of the distribution of the number of candies in the bags is

A. 1 candy
B. 2 candies
C. 3 candies
D. 6 candies

34. For a certain examination, the scores on 1 000 papers are normally distributed with a mean of 62 and a standard deviation of 9. If 650 scores are between 58 and x, then the value of x, correct to the nearest tenth, is

A. 66.3

B. 70.6

C. 76.5

D. 80.5

35. A machine produces an engine part with a mean length of 51.23 mm and a standard deviation of 0.75 mm. The lengths of the engine part are normally distributed, and when a part is less than 50 mm long, it is rejected. The percentage of these engine parts that are rejected, to the nearest whole number, is

A. 2%

B. 5%

C. 45%

D. 95%

Numerical Response

8. The marks on a university entrance examination were normally distributed with a mean of 66. If 4.18% of the students scored less than 33, then the standard deviation of this examination, correct to the nearest tenth, was _____.

(Record your answer in the numerical-response section on the answer sheet.)

36. In the expansion of $(2x - 1)^{10}$, the coefficient of the term containing x^8 is

A. –11 520

B. 45

C. 256

D. 11 520

37. Five different outfits are to be displayed in a store window. From 5 different winter outfits, 3 must be chosen, and from 4 different fall outfits, 2 must be chosen. These outfits will then be arranged in a row in the store window. The number of displays that can be made by choosing the outfits and then arranging them in the window is

A. 300

B. 3 600

C. 7 200

D. 86 400

38. A set of 3 different Mathematics books, 4 different Physics books, and 2 different English books are arranged on a shelf. If the books on each subject are to be kept together, then the number of different arrangements possible for the books is

A. 288

B. 864

C. 1 260

D. 1 728

39. Codes with 4 digits are to be made from the digits 1, 2, 3, 4, 5, 6, and 7. If repetitions are **not** permitted and each code must contain 2 odd digits followed by 2 even digits, then the number of codes that can be formed is

A. 72 codes

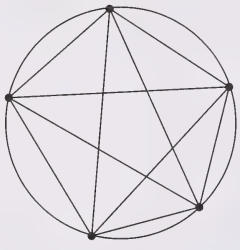
B. 144 codes

C. 210 codes

D. 840 codes

Use the following information to answer the next question.

The diagram below illustrates all the chords that can be drawn using the 5 points given on the circumference of a circle.



40. The number of chords drawn is the same as the number of

A. arrangements of 5 people in a straight line

B. arrangements of 5 people sitting at a round table

C. selections of 2 people from a group of 5 people

D. selections of 1 person for a certain job and 1 other person for a different job from a group of 5 people

Numerical Response

9. A dance class has 14 students. From these, 3 dancers are to be chosen to do a demonstration. The number of different groups of 3 that can be formed is _____.

(Record your answer in the numerical-response section on the answer sheet.)

Written Response—10%

1. The first five rows of Pascal's triangle are written in two ways below.

$$1$$

$$1 \quad 1$$

$$1 \quad 2 \quad 1$$

$$1 \quad 3 \quad 3 \quad 1$$

$$1 \quad 4 \quad 6 \quad 4 \quad 1$$

$$_0C_0$$

$$_1C_0 \quad _1C_1$$

$$_2C_0 \quad _2C_1 \quad _2C_2$$

$$_3C_0 \quad _3C_1 \quad _3C_2 \quad _3C_3$$

$$_4C_0 \quad _4C_1 \quad _4C_2 \quad _4C_3 \quad _4C_4$$

- The sum of the terms in the first 3 rows of Pascal's triangle is shown in the chart below. Determine the sum of the terms in the 4^{th} row, the 5^{th} row, and the 6^{th} row to complete the chart.

Row	1	2	3	4	5	6
Sum of the terms in the row	1	2	4			

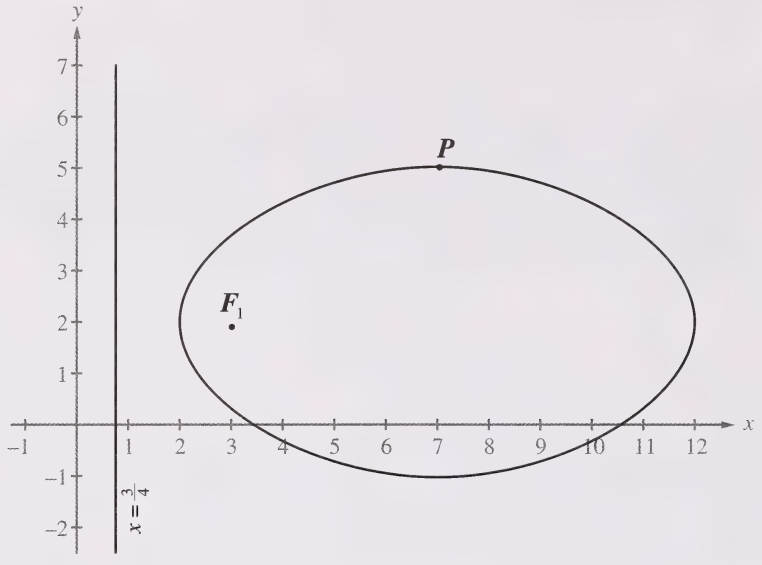
- Determine the sum of the terms in the n^{th} row of Pascal's triangle.

- The sum of the terms in Pascal's triangle can be used to solve many problems. For example, a restaurant owner advertises 128 ways of customizing a hamburger using any combination of the 7 available toppings: ketchup, mustard, onions, lettuce, cheese, tomatoes, and mayonnaise. Explain, using mathematical concepts, why the number of ways of customizing a hamburger with 7 toppings is 128.

Written-response question 2 begins on the next page.

Use the following information to answer the next question.

The graph of an ellipse is shown below. A focus is at $F_1(3, 2)$, and the directrix is the line $x = \frac{3}{4}$. Point $P(7, 5)$ on the ellipse is shown below.



Written Response—10%

2. • Determine the value of the eccentricity of this ellipse. Justify whether or not your value is reasonable for an ellipse.

- The second focus is located at $F_2(11, 2)$. If point P lies on the ellipse, then $\overline{PF_1} + \overline{PF_2}$ is a constant. Determine the value of the constant.

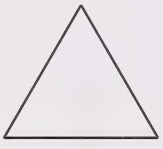
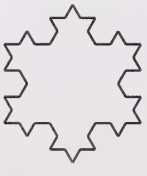
- The locus of points of this conic is centred in quadrant 1. If this conic were written in the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$, $A > 0$, $C > 0$, would the value of D be positive or negative, and would the value of E be positive or negative?

- A student attempts to graph the original conic with the focus at $F_1(3, 2)$ and a point on the conic at $P(7, 5)$. However, the student makes a mistake and uses the line $y = \frac{3}{4}$ as the directrix. What type of conic will result? Justify your answer.

Written-response question 3 begins on the next page.

Use the following information to answer the next question.

A computer programmer developed a screen saver based on Koch's "snowflake." The first generation of the snowflake consists of an equilateral triangle with sides of 1 unit in length. Subsequent generations are created by adding an additional equilateral triangle centred on each outside edge of the geometric figure in the previous generation. The length of each side of the added equilateral triangle is $\frac{1}{3}$ that of the sides in the previous generation. Three generations of the screen saver are shown below.

Generation	Length of Sides of Equilateral Triangles (units)	Number of Outside Edges	Perimeter of Snowflake (units)
1 	1	3	3
2 	$\frac{1}{3}$	12	4
3 	$\frac{1}{9}$	48	$\frac{16}{3}$

Written Response—10%

3. • For the generation 4 snowflake, determine the length of each side of the additional equilateral triangle, the number of outside edges, and the perimeter. Enter these numbers in the chart below.

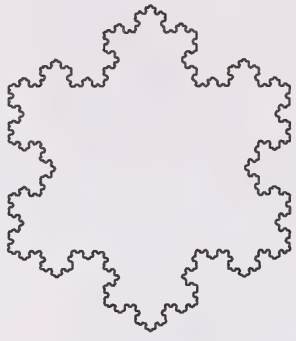
Generation	Length of Sides of Equilateral Triangles (units)	Number of Outside Edges	Perimeter of Snowflake (units)
4	_____	_____	_____

• Write a general expression for the perimeter of the n^{th} generation of the Koch snowflake, where $n \in N$.

Written-response question 3 continues on the next page.

Use the following additional information to answer the next part of the question.

The process of adding equilateral triangles to the outside edges of the snowflake continues, as illustrated below, until the perimeter of the geometric figure first exceeds 1 000 units. At this time, the screen saver stops and defaults back to the beginning with a single triangle that has sides 1 unit long.



- How many complete generations of the snowflake will have occurred when the perimeter of the geometric figure first exceeds 1 000 units?

You have now completed the examination.
If you have time, you may wish to check your answers.

Mathematics 30 Formula Sheet

The following information may be useful in writing this examination.

- The roots of the quadratic equation $ax^2 + bx + c = 0$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- The distance between two points (x_1, y_1) and (x_2, y_2) is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Quadratic Relations

- $e = \dfrac{|\overline{PF}|}{|\overline{PD}|}$

Trigonometry

- arc length $a = r\theta$
- $\sin^2 A + \cos^2 A = 1$
- $1 + \tan^2 A = \sec^2 A$
- $1 + \cot^2 A = \csc^2 A$
- $\csc A = \dfrac{1}{\sin A}$
- $\sec A = \dfrac{1}{\cos A}$
- $\cot A = \dfrac{\cos A}{\sin A}$
- $\sin(A + B) = \sin A \cos B + \cos A \sin B$
- $\sin(A - B) = \sin A \cos B - \cos A \sin B$
- $\cos(A + B) = \cos A \cos B - \sin A \sin B$
- $\cos(A - B) = \cos A \cos B + \sin A \sin B$

Permutations and Combinations

- ${}_nP_r = \dfrac{n!}{(n-r)!}$
- ${}_nC_r = \dfrac{n!}{r!(n-r)!}$
- In the expansion of $(x + y)^n$, the general term is $t_{k+1} = {}_nC_k x^{n-k} y^k$

Sequences and Series

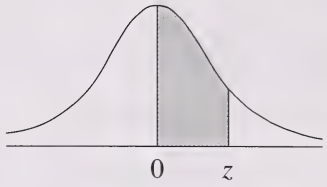
- $t_n = a + (n-1)d$
- $S_n = \dfrac{n[2a + (n-1)d]}{2}$
- $S_n = n\left(\dfrac{a + t_n}{2}\right)$
- $t_n = ar^{n-1}$
- $S_n = \dfrac{a(r^n - 1)}{r - 1}$, $r \neq 1$
- $S_n = \dfrac{rt_n - a}{r - 1}$, $r \neq 1$

Exponential and Logarithmic Functions

- $\log_a mn = \log_a m + \log_a n$
- $\log_a \dfrac{m}{n} = \log_a m - \log_a n$
- $\log_a m^n = n \log_a m$

Fold and tear along perforation.

$$z = \frac{x - \mu}{\sigma}$$



Areas under the Standard Normal Curve

z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

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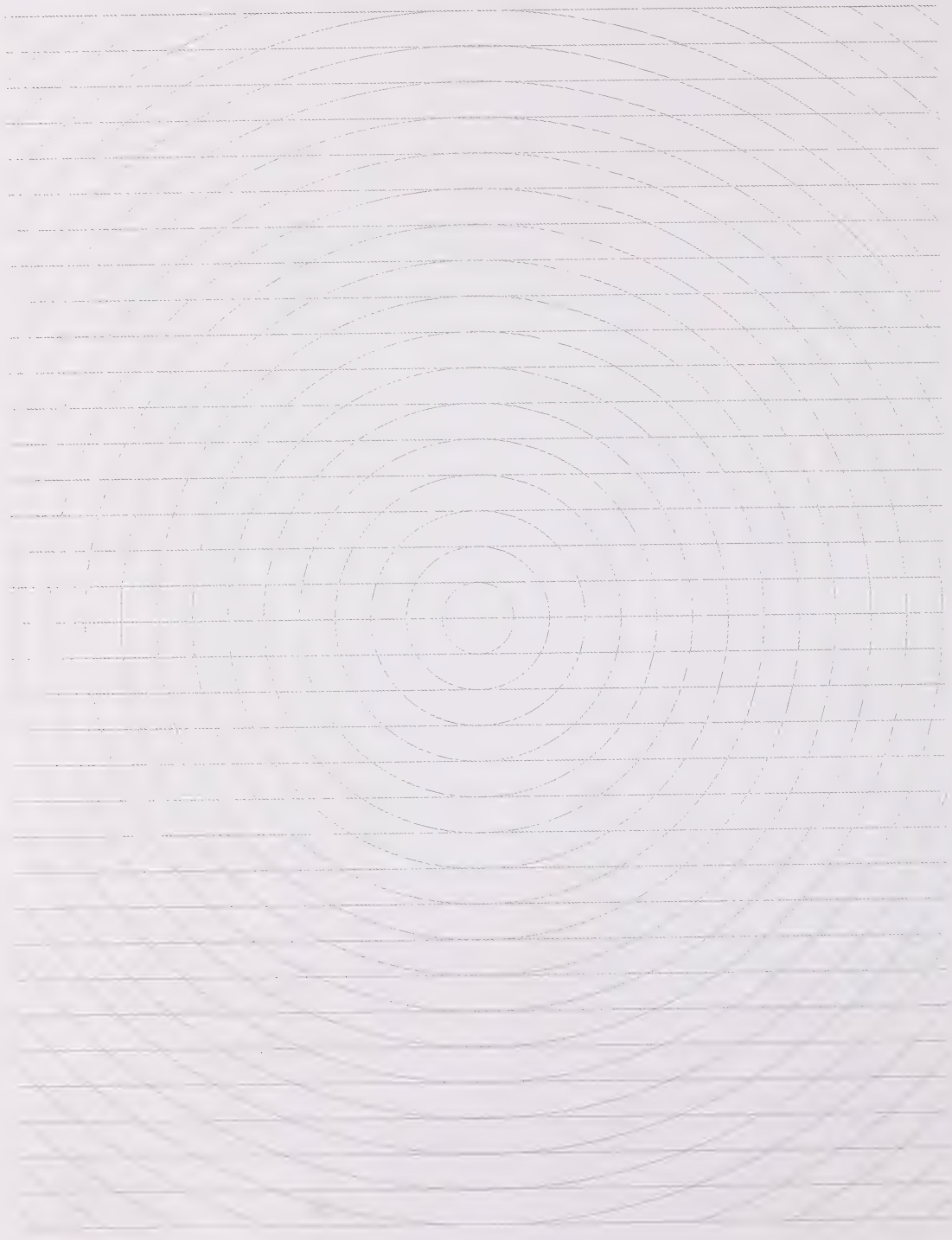

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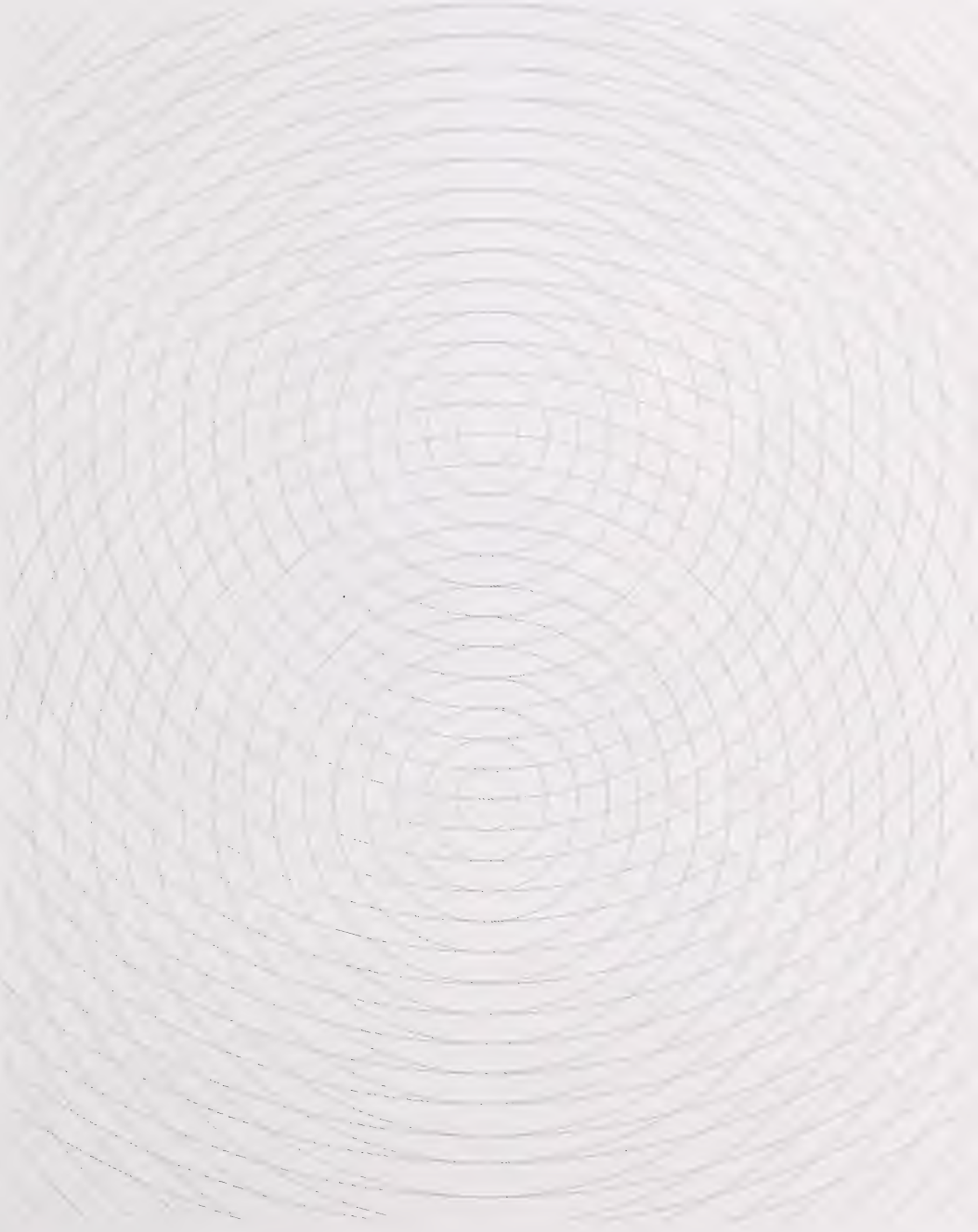

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Mathematics 30

June 2000

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